Remarks/Arguments

These remarks are in response to the Office Action dated June 16, 2006. This reply is timely filed. At the time of the Office Action, claims 1-26 were pending in the application. Claims 1-2 have been rejected under 35 U.S.C. §102(b). Claims 10-11, 18-20 have been rejected under §102(e). Claims 3-9, 12-17, and 21-26 have been rejected under 35 U.S.C. §103(a). The rejections are set out in more detail below.

I. Brief Review of Applicants' Invention

Prior to addressing the Examiner's rejections on the art, a brief review of Applicants' invention is appropriate. The invention relates to a toroidal transformer and methods of forming a toroidal transformer in a ceramic substrate. The invention includes a ceramic substrate comprised of a plurality of ceramic tape layers. One or more of the ceramic tape layers are layered between a plurality of second ceramic tape layers. The first ceramic tape layer has a larger permeability value as compared to the second ceramic tape layers. At least one conductive coil is disposed within the plurality of ceramic tape layers. Moreover, the conductive coil is toroid shaped and has a central axis oriented transverse to the tape layers. The toroidal coil includes a plurality of turns about a region defining a ceramic toroidal core. Notably, the ceramic toroidal core is intersected by the first ceramic tape layer. This substrate configuration of arranging high permeability layers to intersect a core region facilitates the formation of a toroidal core having a high permeability. It also obviates the need for backfilling the toroidal region.

II. Claim Rejections Under 35 U.S.C. §102(b)

a. Claims 1-2

Claims 1-2 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,055,816 to Altman, et al. ("Altman et al."). Altman et al. discloses an electronic device comprised of a pair of coupled inductors with toroidal windings embedded in a carrier, as well as a method of forming the electronic device. The top

and bottom faces of the carrier contain a metallization pattern. The carrier includes a conductive hole pattern in which a plurality of metallizations are connected to the conductive hole patterns, forming the toroidal windings. Notably, Altman et al. fails to disclose a toroidal core formed of a plurality of ceramic tape layers and intersected by at least a first ceramic tape layer having a larger permeability as compared to a second ceramic tape layer.

Amended independent claim 1 recites, in part, a substrate comprised of a plurality of ceramic tape layers. However, Altman et al. fails to disclose a substrate having a plurality of ceramic tape layers. Instead, Altman et al. simply teaches the use of a carrier, without making any mention as to any internal structural layers of which the carrier is constructed (See Col. 4, lines 9-45).

In addition, amended claim 1 recites that at least a first one the ceramic tape layers are layered between a plurality of second ceramic tape layers, the first ceramic tape layer having a larger permeability as compared to the second ceramic tape layers. Since Altman et al. does not teach or suggest the use of a plurality of ceramic tape layers in its carrier, it is clear that Altman et al. also fails to disclose ceramic tape layers having different permeabilities.

Moreover, amended claim 1 recites that the conductive coil comprises a plurality of turns about a region defining a ceramic toroidal core. The ceramic toroidal core is intersected by a first ceramic tape layer. In contrast, Altman et al. fails to disclose a ceramic toroidal core formed by a plurality of ceramic tape layers, much less having layers comprised of different permeabilities.

The above distinctions are important. By forming the toroidal core out of various ceramic tape layers, Applicants' invention permits a toroidal core to be formed without any backfilling steps. Secondly, Applicants' invention facilitates a toroidal core containing an effective permeability that can be selectively tailored based on the type of ceramic tape layers that are combined in a stack. In particular, the idea of intersecting a toroidal core with a first ceramic tape layer having a higher permeability as compared to a second ceramic tape layer facilitates the formation of a toroidal transformer core

region having a high permeability (Applicants' Specification, ¶50). Claim 2 is allowable at least on the basis of its dependence on an allowable base claim.

III. Claim Rejections Under 35 U.S.C. §102(e)

a. Claims 10-11, 18-20

Claims 10-11, 18-20 have been rejected under §102(e) as be unpatentable over U.S. Patent No. 6,914,513 to Wahlers, et al. ("Wahlers et al."). Wahlers et al. discloses a materials system and processing conditions for manufacturing magnetic circuit components such as induction coils and transformers that are non wire-wound. The materials system includes LTCC tape layers with a permeability range of 20-750 to form a magnetic core of the components.

Amended independent claims 10 and 18 recite, in part, the step of positioning at least a first one of the ceramic tape layers at a location layered between a plurality of second ceramic tape layers. Amended claims 10 and 18 also recite the step of selecting a permeability of the first ceramic tape layer to be a larger value as compared to the second ceramic tape layer. Further, amended claims 10 and 18 recite the step of positioning a conductive coil so that it is intersected by the first ceramic tape layer.

However, Wahlers et al. fails to teach the above steps to form the configuration disclosed by Applicants. Instead, Wahlers et al. teaches the formation of ceramic tape layers without necessarily changing the magnetic permeability between layers. The fact that the layers can have a wide range of permeability values is not indicative that the layers in Wahlers et al. are indeed varied. In particular, there is no teaching or suggestion in Wahlers et al. that a first one of the ceramic tape layers is positioned between a plurality of second ceramic tape layers. Moreover, Wahlers et al. fails to show a conductive coil formed in the shape of a toroid that is intersected by a first ceramic tape layer having a larger permeability value as compared to a second ceramic tape layer. Although Wahlers et al. teaches a toroid construction LTCC layers, it fails to show that such layers can be varied in terms of their permeability and according to the recited configuration taught by Applicants' invention (Wahlers et al., Col. 17, lines 21-

40). With regard to claims 19 and 20, these claims are allowable at least on the basis of their dependence on an allowable base claim. Claim 11 has now been canceled.

IV. Claim Rejections Under 35 U.S.C. §103(a)

a. Claims 3, 8 and 9

Claims 3, 8 and 9 have been rejected under 35 U.S.C. §103(a) as being unpatentable over unpatentable over Altman et al. in view of U.S. Patent No. 5,029,043 to Kitahara et al ("Kitahara et al"). However, claims 8-9 are allowable at least on the basis of their dependence on an allowable base claim. Claim 3 has now been canceled.

b. Claims 4-5

Claims 4-5 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Altman et al. in view of U.S. Patent No. 6,847,282 to Gomez et al., ("Gomez et al."). However, claims 4-5 are allowable at least on the basis of their dependence on an allowable base claim.

c. Claims 6-7

Claims 6-7 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Altman et al. in view of U.S. Patent No. 6,148,500 to Krone et al. ("Krone et al."). Krone et al. teaches inductive electrical components, such as inductors and transformers, which are embedded in an insulating board having conductive layers. Conductive though-holes are disposed in the board on opposite sides of a core. The conductive layers are patterned to form with the conductive through-holes one or more sets of conductive turns forming a winding or windings encircling the core. According to one embodiment, a first toroidal coil is disposed within a second toroidal coil. Notably, the first and second toroidal coils share a toroidal ferromagnetic core that is installed in a core hole (Krone et al., Col. 3, lines 37-47; Figs. 5-6).

Applicants' amended claim 6 recites that a toroidal core of a second conductive coil is also intersected by a first ceramic tape layer. Although Krone et al. teaches a first

toroidal coil within a second toroidal coil structure, the toroidal core that is shared by the first and second coils is not formed by stacked ceramic tape layers. Rather, Krone et al. teaches that the toroidal ferromagnetic core is independently backfilled into a core hole (Krone et al., Col. 3, lines 37-47; Figs. 5-6). Neither Altman et al., Krone et al., nor their combination teach a portion of a toroidal core shared by a first and second conductive coils that is intersected by a first ceramic tape layer. Claim 7 has now been canceled.

d. Claims 14-16 and 23-25

Claims 14-16 and 23-25 have been have been rejected under 35 U.S.C. §103(a) as unpatentable over Wahlers et al. in view of Krone et al. However, claims 14-16 and 23-25 are allowable at least on the basis of their dependence on an allowable base claim.

e. Claims 12-13 and 21-22

Claims 12-13 and 21-22 have been rejected under 35 U.S.C. §103(a) as unpatentable over Wahlers et al., in view of Gomez et al. The Wahlers et al. reference is discussed in section III.a. of this document. Gomez et al. discloses a cylindrical shaped inductor that is formed by stacking various substrate layers. Each substrate layer has a spiral conductive pattern. A continuing interconnection electrically couples a first spiral conductive pattern on a first substrate layer to a second spiral conductive pattern located on a second substrate layer. In addition, a conductive shield pattern 516 is disposed on a third surface 534 of a third substrate layer (See Fig. 8 of Gomez et al.). The shield pattern 516 can serve as a ground that provides a shielding function that reduces unwanted electromagnetic interaction between inductor 500 and other electronic components (Gomez et al., Col. 5, lines 11-16).

Amended independent claims 13 and 22 recite several steps that are not taught by either Wahlers et al. or Gomez et al. For example, amended claims 13 and 22 recite positioning at least a first one of the ceramic tape layers at a location layered between a plurality of second ceramic tape layers. Moreover, claims 13 and 22 teach selecting a permeability of the first ceramic layer to be a larger value as compared to the second

ceramic tape layers. Neither Wahlers et al. nor Gomez et al. teach positioning a first ceramic tape layer between a plurality of second ceramic tape layers.

Wahlers et al. teaches the formation of ceramic tape layers without necessarily changing the magnetic permeability between layers. The fact that the layers can have a wide range of permeability values is not indicative that the layers in Wahlers et al. are indeed varied. In particular, there is no teaching or suggestion in Wahlers et al. that a first one of the ceramic tape layers is positioned between a plurality of second ceramic tape layers, whereby the first ceramic tape layer has a larger permeability value as compared to a second ceramic tape layer.

Similarly, Gomez et al. fails to make up for the deficiencies present in Wahlers et al. Gomez et al. does not teach or suggest that its substrate layers have different permeability values. Specifically, Gomez et al. fails to teach a first ceramic tape layer having a higher permeability value as compared to a second ceramic tape layer. Moreover, Gomez et al. does not teach the idea of positioning the first ceramic tape layer between a plurality of second ceramic tape layers as disclosed by Applicants. With regard to claims 12 and 21, these claims are allowable at least on the basis of their dependence on amended independent claims 10 and 18, respectively.

f. Claims 17 and 26

Claims 17 and 26 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Wahlers et al. in view of U.S. Patent No. 4,626,816 to Blumkin et al. ("Blumkin et al."). Blumkin et al. discloses a coil assembly having planar spiral conductive coils on an insulative slab. The coil can include external tabs to tap into the coil assembly at a desired point, such that the coil can be used as an auto-transformer. Nevertheless, claims 17 and 26 are allowable at least on the basis of their dependence on an allowable base claim.

V. Conclusion

Applicants have made every effort to present claims which distinguish over the prior art, and it is believed that all claims are in condition for allowance. Nevertheless, Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. In view of the foregoing remarks, Applicants respectfully request reconsideration and prompt allowance of the pending claims.

Respectfully submitted,

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